# A Fabric Revolution

## AFFOA Is Weaving the Next Fiber and Textile Revolution

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Our clothes help define us, yet the fabrics we wear have remained virtually unchanged in many respects for thousands of years. Recent breakthroughs in fiber materials and manufacturing processes soon will allow us to design and manufacture fabrics that see, hear, sense, communicate, store and convert energy, regulate temperature, monitor health and change color—heralding the dawn of a "fabric revolution."

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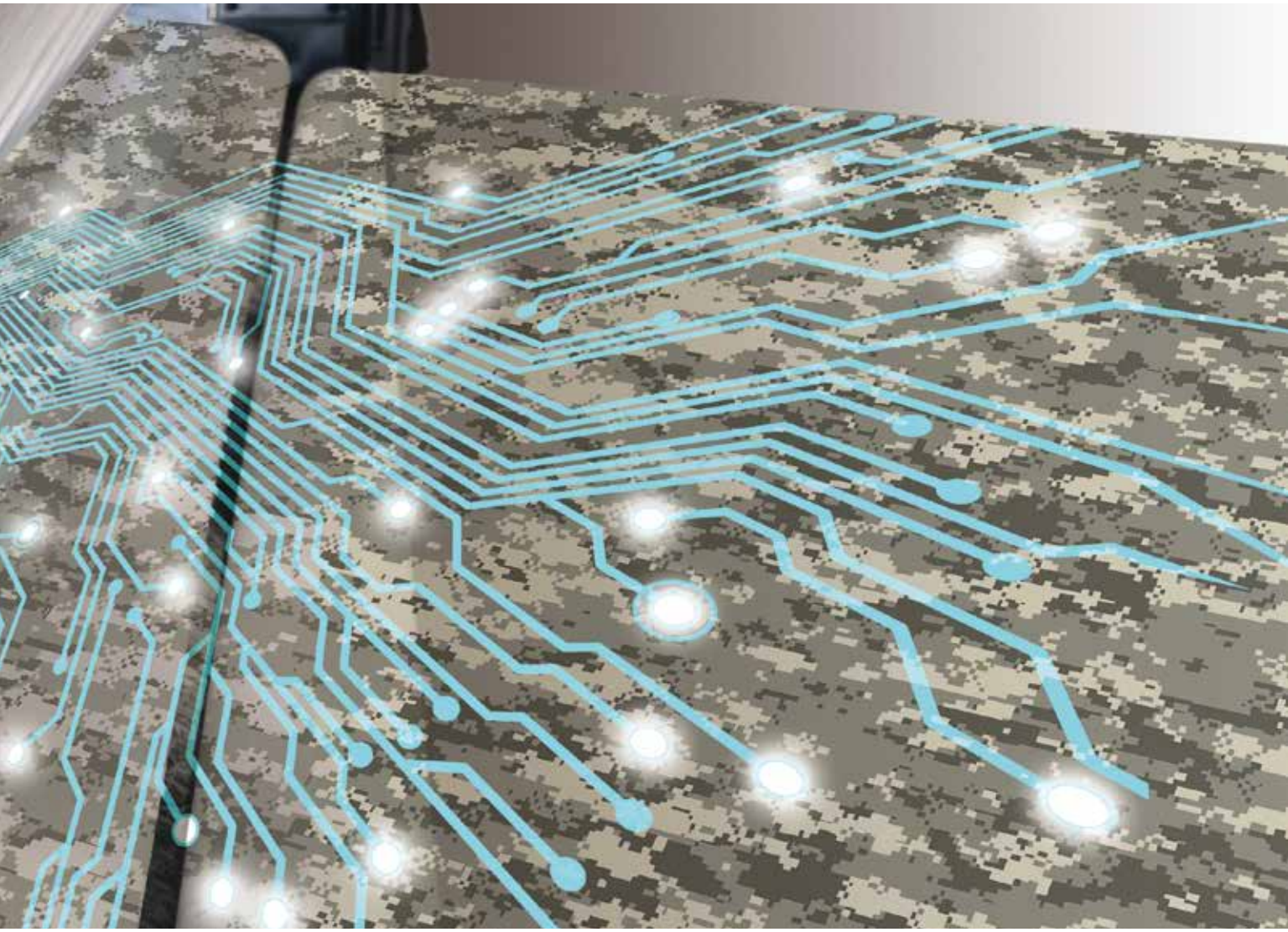

After a decline in U.S. manufacturing during the 2000s, the American textile industry is adding jobs for the first time in 2 decades, increasing shipments by 14 percent from 2009 to 2015, and winning globally with a 39 percent increase in exports from 2009 to 2015. Across the country, U.S. manufacturing as a whole has added almost 900,000 jobs since turning the corner in February 2010.

To take advantage of this textile industry upsurge, a consortium of universities and manufacturers, in conjunction with the Department of Defense (DoD), launched a manufacturing innovation institute that plans to lay the foundation for future leadership in producing sophisticated fibers and textile technologies. Headquartered at MIT in Cambridge, Massachusetts, the Advanced Functional Fabrics of America (AFFOA) is the eighth institute established as a part of the National Network for Manufacturing Innovation (NNMI) program intended to help restore U.S. manufacturing leadership. AFFOA combines $75 million of federal resources with $240 million of nonfederal investment to overhaul American fibers and textiles manufacturing and foster technological innovation in futuristic fabrics and textiles. These will include super-durable, super-lightweight, flame-resistant, and electronic-sensor capabilities that can save the lives of civilians and soldiers alike, and help accelerate the revival of textile manufacturing in the United States.

AFFOA is the nonprofit organization stood up by MIT and unites 89 partner companies, nonprofits, independent research organizations, universities and startup incubators in an effort to ensure that America stays at the leading edge of fiber science and the production of fibers and fabrics incorporating advanced properties.

AFFOA is a public-private partnership intended to generate innovation that will benefit defense and commercial needs. However, the institute will focus

on technologies that have commercial viability since defense requirements often are insufficient by themselves to underpin the development, growth and sustainment of emerging industries to produce leading-edge defense systems. The DoD needs a vibrant, domestic commercial base and these public-private manufacturing research partnerships will contribute to that capability. As a result, the institute will address gaps in textile and fiber manufacturing technology that are common to both commercial and defense applications.


Operationally, the DoD's overarching role is to help establish the institute through federal funding cost share and to partner in providing oversight and stewardship. The DoD's military and civilian agency representatives also will contribute ongoing technical advice and assistance. The institute will have an independent governing council predominantly composed of industry representatives.

AFFOA will bring together fiber and textile manufacturers, system integrators and product companies to transform traditional fibers, yarns and textiles into highly sophisticated, integrated and networked devices and systems. To pursue this mission, the institute will establish a nationwide network that addresses the spectrum of manufacturing challenges associated with multi-component, functional fibers and technical textiles—from design to end products through deliberate plans, projects, and programs. AFFOA also will develop and scale critical manufacturing processes for revolutionary fibers and textiles and mature them to Manufacturing Readiness Level (MRL)-4 to MRL-7. The institute also will provide guidance and serve as a transition partner to accelerate lower MRL activities.

AFFOA will provide aggressive technology transfer, prototyping and pilot production facilities throughout the Fiber Innovation Network (FIN). The institute will rapidly and flexibly produce end-item prototypes through this unique FIN collaborative infrastructure and a suite of computational design tools that are a focus of development. The technology strategy is to combine fibers and yarns with integrated circuits, LEDs, solar cells, and other capabilities to create textiles and fabrics for a variety of industries, such as apparel, automotive, medical, defense, and sports and leisure.

AFFOA also will help commercialize breakthrough innovations in the labs of leading member universities and others, while partnering with local workforce organizations to train workers on how to manufacture these technologies in the United States. AFFOA will support a cross-disciplinary, skills-based workforce and education plan and dedicated start-up incubators, driving innovations for the entire U.S. industry. The institute's headquarters will host a unique prototype facility designed to help start-ups test their first products and scale up new technologies into full production, helping ensure that textile technologies invented in America are manufactured in America.

The institute's scope will encompass novel commercial and DoD products such as:

- Shelters with power generation capability and storage capacity built into the fabric
- Ultra-hydrophobic, insulated tents that keep hikers and soldiers dry under extreme weather conditions
- "Smart" soldier uniforms enabled with friend/foe identification that allow for power and data transmission through the fabric
- Textiles that sense chemical/biological/radiological/nuclear agents, provide sound reduction, and enable solar generation of power from the fabric itself
- Apparel capable of changing color, based upon environmental conditions or wearer needs, monitoring health factors to both sense and treat injury, generating and/or storing energy from the wearer's activity, and auto-regulating the wearer's body temperature
- Thermal insulation with low bulk that is lightweight, comfortable and able to adapt to both hot and cold environments
- Home insulation and road construction materials that can monitor the performance of insulation and water permeability to react to varying environmental conditions

Since all of the Manufacturing Innovation Institutes were created to bridge the gap between basic research and development (R&D) and its products, and to create a sustainable, domestic manufacturing ecosystem, a Technology Investment Agreement (TIA) was selected as the most appropriate contract instrument. A TIA enables work on applied and advanced research projects that are relevant to the policy objective of civil-military integration and the creation of a single, national technology and industrial base to support national defense needs.

The basic idea behind a TIA is flexibility. TIAs allow the DoD to contract with firms that will not, or cannot, participate in government cost-reimbursement R&D Federal Acquisition Regulation contracts or standard federal assistance awards. These contractors might be small, startup technology firms supported by venture capital, leading-edge technology firms that haven't worked on a government R&D contract, or industry giants that have chosen not to operate in the government market. The contract with AFFOA is administered through the Army Contracting Command-New Jersey (ACC-NJ) and provides for 5 years of operation and a 6-month standup phase.

AFFOA's near-tem priority is to stand up its operations. The leadership team will work to finalize agreements with member companies, and universities, establish operations within the headquarters, and develop a roadmap to guide technical project development. The exact natures of the projects to be executed have yet to be defined, though the proposal included three sample projects, one of which focuses on Data Management, Modeling and Analytics throughout the Textile Supply Chain. The government and AFFOA see this as a foundational project for the institute, as it will provide the community with design tools needed by textile end-users to deploy new manufacturing technologies. It is expected that this will be one of the first projects executed within the institute.

AFFOA also will provide significant educational opportunities to improve and expand the manufacturing workforce, including kindergarten through 12th-grade programs, internship opportunities, skills certification, community college engagement, university collaboration, graduate studies, postdoctoral studies, and retraining to meet the requirements of the institute's mission.

## AFFOA: Weaving Together Commerce and Defense

The DoD has a history of investing in forward-looking technologies to give the warfighter advantages on the battlefield. AFFOA, like the other Manufacturing Innovation Institutes, represents a broad strategic partnership with academia and industry to allow new science and technology to generate commercially viable applications that will have dual use applications, civilian and military. For example, in textile manufacturing, electronic textiles that enhance warfighter health monitoring also could support the collection of patient medical data in hospitals. The DoD's intimate involvement in the planning and oversight of AFFOA ensures that defense and battlefield applications will be built into the R&D process from the outset. For the DoD, AFFOA is a cost-effective strategy to expand domestic innovation capacity and to leverage scarce DoD resources.

AFFOA also will help stitch DoD and the textile industry more tightly together. DoD prefers that a domestic supply chain manufacture its products, but many commercial companies are vulnerable to ebbs and flows in the defense demand cycle. In past years, some have moved their operations overseas, weakening the U.S. supply chain. Manufacturing Innovation Institutes, such as AFFOA, provide an opportunity for the government to invest in new manufacturing technologies that will enhance both defense and commercial products and reestablish shared and balanced manufacturing capability that allows companies to bring more and better textile jobs home. For industry and government alike, AFFOA creates a stronger fabric of support.


For more information, see the website at http://join.affoa.org/

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